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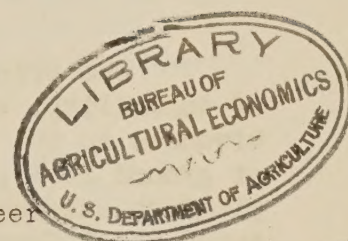


UNITED STATES DEPARTMENT OF AGRICULTURE  
Bureau of Agricultural Engineering

POTENTIAL MECHANICAL IMPROVEMENTS INVOLVED  
IN MODERNIZING COTTON GINS

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COTTON DIVISION COPY

"To modernize or not to modernize, that is the question." To paraphrase an ancient saying, that question is frequently uppermost today in the mind of the progressive ginner who is endeavoring to render the farmer a beneficial and profitable service. To answer this question is far from easy, but there are significant potentialities of modernization worthy of consideration, and the first step in their analyses is to outline in general just what is a modern cotton gin.

A modern cotton-ginning plant is fire-proof, conveniently arranged inside and outside, and properly lighted and ventilated, either artificially or naturally. It has an adequate amount of conditioning, cleaning and extracting equipment, and its gin stands are equipped with huller fronts for further cleaning of the cotton. Its conditioning apparatus provides for mechanically drying green, damp or wet cotton. The saw shafts of the gin stands are preferably direct-connected, and the machinery is driven with the minimum number of belts and shafting. Bearings are of the anti-friction type instead of the old babbitt design. Cotton piping and fans are of sizes that contribute to economy in power consumption. Modern screw conveyors are employed in lieu of older forms of bucket elevators and seed blowers; seed is kept pure by drag belts in steel troughs; and power transmitting equipment is efficient and safely guarded against accident and faulty operation. Seed scales are rapidly becoming standard equipment for accurately determining the weights of seed purchased from the customers, and convenient water-proof metal hoppers for depositing the seed in the farmer's wagon or truck are maintained.

Foreign matter is disposed of mechanically and removed a proper distance from the plant. Adequate facilities for bale storage and protection against fire or weather hazards are also required in the modern gin; and shelter sheds for waiting customers, together with cotton storage, are becoming essential facilities in many regions.



From the foregoing brief outline of a modern gin, we are confronted first with those problems pertaining to the buildings, next equipment, and finally operation, each element of which is important in the inter-relationships with the others and to improved ginning service for the farmer customer.

## GIN BUILDINGS

The principal considerations involved in gin buildings are those of durability, serviceability, minimum upkeep and insurance, and attractiveness to the public. The trend is toward installation of machinery at ground level, with the press also at ground level or on a low concrete platform extended to form the cotton dock. It is also evident that fabricated steel frames and galvanized metal sheeting and roofing are rapidly replacing older wooden forms of erection. With such fireproof methods of construction come better light and ventilation, and far greater stability and resulting longevity in the machinery installations.

Thus far the most advantageous forms of building arrangements are yet to be fully standardized, and ingenious planning may offer valuable opportunities for more economical operation. For instance, our American engineers, who have installed cotton ginning equipment in South America, have adopted a single-line-type of construction with the seed cotton storage at one end of the building, a brick firewall separating it from the ginning equipment, and another brick firewall dividing that in turn from the seed and bale compartments at the opposite end of the building. By this means the entire organization is under one roof, requiring a minimum of supervision, piping and labor.

The many advantages of this newer and potentially effective layout are obvious; and by the provision of overhung side shelters the protection of customers' loads of incoming seed cotton or outgoing products is assured. This case is mentioned as an excellent example of the possibilities which modernization holds forth for reduction in first costs of the ginning plant, as well as in the reduction of labor, supervision and operation expenses.

## GINNING EQUIPMENT

The Department of Agriculture has found that the average cotton farmer is reasonable in his consideration of equipment that handles his crops. His confidence in good ginning equipment has been repeatedly demonstrated, and the ginner may be assured that the broad activities of state and federal extension services are rapidly acquainting the farmer with dependable information about good ginning practices and kinds of equipment.

Mr. Gerdes has pointed out to you how essential it is that the farmers improve their harvesting practices, but there are unavoidable periods during the ginning season when green, damp or wet seed cotton



are encountered <sup>1/</sup>. Hence cotton driers are coming to be essential to the modern gin. In Texas there are 234 now in operation, and in other states the number is rapidly increasing. Although some manufacturers prefer to use the term "conditioner" rather than "drier", the Department of Agriculture is hopeful that neither will remove any more moisture from the seed cotton than is essential to improved ginning, and that enthusiasm on the part of the operators will not be reflected in the employment of higher temperatures than have been shown to be beneficial.

Driers and conditioners - name them as you will - comprise a valuable aid to the modern ginner in many ways. First - they enable him to render the best service with the least equipment, because dried cotton is more readily cleaned, extracted and ginned. Second - they economize on energy consumption and power by reducing the load and eliminating chokages and breakdowns. And third - they manufacture sunny days within a cotton gin when the weather outside is inclement; thus permitting the cotton farmer to preserve his harvest.

Cleaning and extracting processes are essential at modern gins, but they should not be excessive in elaborateness or cost, and the farmer should not be encouraged to adopt rough harvesting practices merely because the gin is equipped with such machinery. While it has been demonstrated from our many tests that extensive cleaning and extracting do not seriously damage dry cotton, nevertheless the modern gin is tending toward two very simple forms of cleaning and extracting installations - both of which are especially suitable in Alabama. In one method all of the cleaning and extracting is concentrated in the simple unit extractors over the gin stands, supplemented by the huller fronts of the gin stands themselves. In the other method, some form of overhead cleaner is employed in conjunction with big drum cleaning feeders over the gin stands, and these in turn are likewise supplemented by the huller fronts. Either method is quite satisfactory where the cottons are not harvested too roughly; and both permit the installation of drying or conditioning systems in a number of economical ways.

The selection of separators and distributors is of importance chiefly from an operating point of view. They form the back-bone of the ginning system proper, and the judicious selection of improved separators and distributors is vital to profitable operation.

Separators affect the energy consumption of a ginning outfit to an astonishing degree by the loads that they tend to impose upon the cotton fan. Although the laboratory tests on fans and separators have just begun, it is being found that air leakages of 39 percent or more are occurring in the separators. In one test the fan was actually handling 5,100 cubic feet and the separator leakage was 2,036 cubic feet per minute. In that instance, the wagon suction was deprived of

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<sup>1/</sup> Possibilities of Benefitting Cotton Quality by Cotton Gin Improvement, by Francis L. Gerdes.

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its suction to an appreciable extent, and the fan was consuming much more energy than was necessary for effective cotton handling. Old separators that are sealed by distributor belt flaps are undoubtedly losing 50 percent or more - an intolerable loss to the industry that easily ranges from five to fifteen horsepower per fan. Thus, the selection of a separator should be made with a view to obtaining maximum tightness and freedom from leakage, together with a minimum amount of packing or wiping strips to keep in shape. It is believed that the latest types of modern revolving-screen separators with vacuum wheel droppers approach this requirement.

Screw and gyrator types of distributors are now considered to be more economical in operation and superior in durability to the older belt and pneumatic types of distributors. They do not tend to pack the cotton into the feeder chutes and may be readily cleaned out when different varieties of cottons are ginned.

Today's standard in gin stands calls for double rib huller gins, because they have tested out better than single rib plain or single rib huller units. Further improvements are, of course, inevitable, and it is not the intention of the Department to give out an impression that the millenium has been reached in gin stand construction. Nevertheless, the manufacturers are to be congratulated upon the great advances and improvements that they have achieved during the past seven years.

The tests of the Department of Agriculture have brought forth many interesting facts regarding gin saws. They have disclosed that from 280 to 300 teeth per gin saw produce faster ginning and more lint per bale than other degrees of fineness. They have also disclosed the advantages of a straight-back tooth; but when increased pitch has been combined with increased fineness there have not been any significant gains in performance over their use singly.

Modernization appears to offer a very potential improvement with regard to fans and piping. We have for several years been advocating the scrutiny and testing of these items, and the extensive research tests now underway at the U.S. Cotton Ginning Laboratories are expected to provide for the first time a concise body of operating information for cotton gins. With good separators a ten-inch telescope and piping should economically serve a 3-80 outfit without using more than 7 or 8 horsepower, and eleven-inch piping should also handle a 4-80 with not to exceed 9 or 10 horsepower, although poor separators will double this energy consumption.

Seed blowing is another source of energy consumption that seldom is warranted when one considers how much more effectively seed are being transferred by belt and screw conveyors. For example, one test showed approximately  $5\frac{1}{4}$  horsepower requirement for a fan and 50 foot wagon suction, with a free discharge from the fan. With seed blowing, for an equal volume of air the fan had to be speeded up 250 revolutions per minute and the horsepower was increased to approximately  $13\frac{1}{2}$ .



## OPERATING AND MAINTENANCE

From time to time the results of the findings of the ginning laboratory have been published in Departmental Bulletins and articles for trade magazines. It would therefore be appropriate to assume that the progressive ginner is familiar with these, the more important of which are tabulated below, and that we may at this time briefly recapitulate the salient features of operation that they cover.

With regard to cotton drying and conditioning, we know that the temperature at the inlet to the drier should seldom exceed 150 to 160 degrees Fahrenheit, nor go beyond 200 degrees as a general limit.

Ginning with a loose seed roll has been proved to be of primary importance, but variations of saw speeds within certain limits have been shown to have only a secondary effect.

Cleaning and extracting may be accomplished by various machinery combinations, among which the two simplest and most advantageous have been stated. The use of double rib huller gin stands, as an important part of these set-ups has been stressed, and the significance of good distribution has been mentioned.

Maintenance of or slight increases in factory pitch for cotton gin saws is desirable, and those degrees of fineness and the straight back shape of tooth for better performance have been demonstrated.

Operating costs have been influenced by separators, fans and piping to a much greater degree than has been heretofore believed, and the modernized cotton gin must include improvements in these features if it expects to reap any profitable reward in lower expenses.

Finally, modernization includes not only better equipment and improved ginning practices but also an active participation in spreading information to cotton farmers whereby the mutual interests of all concerned may be advanced, and the quality of American cottons enhanced in the markets of the world.



LIST OF COTTON GINNING BULLETINS NOW AVAILABLE FROM

UNITED STATES DEPARTMENT OF AGRICULTURE

- Farmers' Bulletin 1748.- "GINNING COTTON" - By Chas. A. Bennett, Senior Mechanical Engineer, Bureau of Agricultural Engineering, and F. L. Gerdes, Associate Cotton Technologist, Division of Cotton Marketing, Bureau of Agricultural Economics.
- Technical Bulletin 503.- "EFFECTS OF GIN-SAW SPEED AND SEED-ROLL DENSITY ON QUALITY OF COTTON LINT AND OPERATION OF GIN STANDS" - By Chas. A. Bennett, Senior Mechanical Engineer, Cotton Ginning Investigations, Bureau of Agricultural Engineering, and Francis L. Gerdes, Associate Cotton Technologist, Division of Cotton Marketing, Bureau of Agricultural Economics.
- Technical Bulletin 508.- "EFFECT OF ARTIFICIALLY DRYING SEED COTTON BEFORE GINNING ON CERTAIN QUALITY ELEMENTS OF THE LINT AND SEED AND ON THE OPERATION OF THE GIN STAND" - By Francis L. Gerdes, Associate Cotton Technologist, Division of Cotton Marketing, Bureau of Agricultural Economics, and Chas. A. Bennett, Senior Mechanical Engineer, Cotton Ginning Investigations, Bureau of Agricultural Engineering.
- Miscellaneous  
Publication 239.- "THE VERTICAL DRIER FOR SEED COTTON"- By Chas. A. Bennett, Senior Mechanical Engineer, Cotton Ginning Investigations, Bureau of Agricultural Engineering, and Francis L. Gerdes, Associate Cotton Technologist, Division of Cotton Marketing, Bureau of Agricultural Economics.
- Circular 393 - "CARE AND MAINTENANCE OF COTTON-GIN SAWS AND RIBS" - By Chas. A. Bennett, Senior Mechanical Engineer, Cotton Ginning Investigations, Bureau of Agricultural Engineering, and Francis L. Gerdes, Cotton Technologist, Division of Cotton Marketing, Bureau of Agricultural Economics.